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Owen Chamberlain
Nobel Laureate – 1959

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"By Jove, this is what I want to do."[1] And so began Owen Chamberlain's successful quest to verify the existence of the antiproton, a proton having a negative electrical charge. First proposed by Paul Dirac in 1930, the positron remained an elusive construct until Chamberlain and Emilio Segre proved its existence in 1955.[2] Their discovery, published in *Physics Review*, was followed by the 1959 Nobel Prize in Physics.[3]

Born in 1920, Chamberlain showed an early aptitude for both mathematics and physics, graduating with honors from Dartmouth College in 1941. With the Thayer Prize for Mathematics in hand, Chamberlain began graduate work at Berkeley. When war broke out, he abandoned his studies, joining a research team investigating spontaneous fission in uranium. This team, led by Emilio Segre, moved to Los Alamos in early 1943, where Chamberlain contributed to the discovery of a much higher than predicted spontaneous fission rate in plutonium. This finding caused a major reorganization of Los Alamos in August 1944 leading to the development of Fat Man, the bomb type tested at Trinity Site in July 1945.[4]

After the war, Chamberlain enrolled at the University of Chicago, where he studied under Nobel Laureate Enrico Fermi. In 1948, while still working on his doctorate, Chamberlain was hired as an instructor at the University of California – Berkeley, where he would spend the rest of his professional career. His early research focused on proton-proton scattering, work that contributed to his hypothesis that the mass and charge of an antiproton could be measured by its momentum and velocity. When well-known physicist Maurice Goldhaber made a public bet that the antiproton did not exist, Chamberlain decided then and there to prove his colleague wrong.

The seminal experiment that led to the discovery of the antiproton began in the summer of 1955. As later described by a colleague, Herbert Steiner:

> The proton beam in the Bevatron was used to produce secondary particles in a copper target. A series of magnets then transported a negatively charged beam of known momentum to the velocity-defining detectors. Two scintillation counters, separated by 13 meters, were used to measure the 13 nanosecond time difference between the rare antiprotons and the much more copiously produced pions in the beam.[5]

[1] Steiner, Herbert. Owen Chamberlain, 1920-2006: A Biographical Memoir. Washington, D.C.: National Academy of Sciences, 2010. P. 12-13.
[2] Dirac, P.A.M., Proceedings of the Royal Society of London. A 126 (1930), 360; A 133 (1931), 60.
[3] Chamberlain, O., E. Segre, C.E. Wiegand, and T. Ypsilantis. Physics Review, 100 (1955), 947.
[4] Unappreciated at the time, Chamberlain's work on spontaneous fission led to the discovery of a new isotope of plutonium, ^{240}Pu.
[5] Steiner, 13.

Chamberlain later said,

> Fortunately the antiprotons were slightly more numerous [than predicted], "being 1 in 30,000 particles [rather than the predicted 1 in 100,000] in the magnetized beam. If there had been appreciably fewer antiprotons, we might altogether have missed seeing them on the first try. As it was, we saw only one antiproton for every fifteen minutes with the first apparatus.[6]

The discovery of the antiproton was significant because it advanced the fundamental understanding of nature and its constituent particles. This new understanding led to the discovery of a third subatomic particle, the antineutron.[7] After a quarter century, Dirac's theory became a reality. Chamberlain's work also confirmed the theory that antiprotons are born "in pairs with ordinary protons and neuron" that die by annihilation – contact with its opposite number.

After the discovery of the positron, Chamberlain devoted much of his remaining career to polarization studies, including the development of polarized targets that became a standard part of particle physics research worldwide. Chamberlain himself, conducted the first use of these new targets for experiments "using high energy proton and pion beams." Among the last of his intensive research activities included work at the Stanford Linear Accelerator Center to improve the precision of "the Standard Model of electro weak interactions."[8]

Although advancing age and Parkinson's disease slowed down Chamberlain's physical activities, he remained intellectually active up to his death, which occurred on February 28, 2006.

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[6] Chamberlain, Owen. The Early Antiproton Work. Nobel lecture, December 11, 1959. P. 502.
[7] Ibid. 504. The first subatomic particle, the positron, or antielectron, was discovered in 1932.
[8] Steiner, 18.